CLAIMS

1. A method of forming a laminated photoresist which comprises:

(I) a step for forming a photoresist layer (L1) on a substrate and

(II) a step for forming an antireflection layer (L2) on the photoresist layer (L1) by applying a coating composition comprising a fluorine-containing polymer (A) having hydrophilic group Y;

said fluorine-containing polymer (A) has a structural unit derived from a fluorine-containing ethylenic monomer having the hydrophilic group Y and is characterized in that:

(i) the hydrophilic group Y contains an acidic OH group having a pKa value of not more than 11,

(ii) a fluorine content is not less than 50 % by mass, and

(iii) the number of moles of the hydrophilic group Y in 100 g of the fluorine-containing polymer (A) is not less than 0.14.

2. The method of forming a laminated photoresist of Claim 1, wherein in the fluorine-containing polymer (A), the hydrophilic group Y containing an acidic OH group is -OH having a pKa value of not more than 11 and/or -COOH having a pKa value of not more than 11.

3. The method of forming a laminated photoresist of Claim 1 or 2, wherein the number of moles of the hydrophilic group Y in 100 g of the fluorine-containing polymer (A) is not less than 0.21.

4. The method of forming a laminated photoresist of Claim 1,

wherein the hydrophilic group Y in the fluorine-containing polymer (A) is -COOH and the number of moles of -COOH in 100 g of the polymer is not less than 0.21 and not more than 0.290.

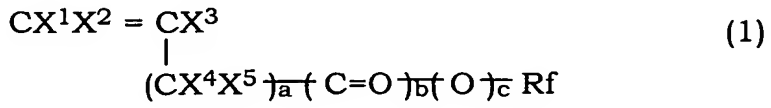
5. The method of forming a laminated photoresist of Claim 1 or 3, wherein the hydrophilic group Y in the fluorine-containing polymer (A) is -COOH and a number average molecular weight of the polymer is from 10,000 to 750,000.

6. The method of forming a laminated photoresist of Claim 1 or 3, wherein the hydrophilic group Y in the fluorine-containing polymer (A) is -COOH and a number average molecular weight of the polymer is from 31,000 to 750,000.

7. The method of forming a laminated photoresist of any of Claims 1 to 6, wherein the fluorine-containing polymer (A) is represented by the formula (M-1):

- (M1) - (N1) - (M-1)

wherein the structural unit M1 is a structural unit derived from a fluorine-containing monomer represented by the formula (1):



(1)

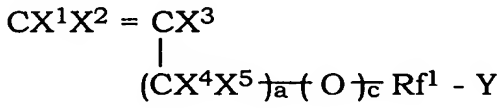
wherein X^1 and X^2 are the same or different and each is H or F; X^3 is H,

F, Cl, CH_3 or CF_3; X^4 and X^5 are the same or different and each is H or F; Rf is a monovalent organic group in which 1 to 4 hydrophilic groups Y are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a monovalent organic group in which 1 to 4 hydrophilic groups Y are bonded to a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether bond; a, b and c are the same or different and each is 0 or 1,

the structural unit N1 is a structural unit derived from a monomer copolymerizable with the fluorine-containing monomer of the formula (1), and

the structural units M1 and N1 are contained in amounts of from 30 to 100 % by mole and from 0 to 70 % by mole, respectively.

8. The method of forming a laminated photoresist of Claim 7, wherein the structural unit M1 is a structural unit derived from a fluorine-containing monomer represented by the formula (2):

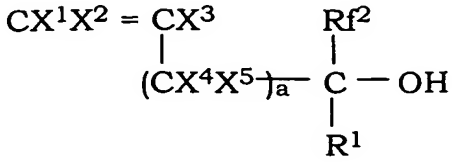


(2)

wherein X^1, X^2, X^3, X^4, X^5, a, c and Y are as defined in said formula (1); Rf^1 is a divalent fluorine-containing alkylene group having 1 to 40 carbon atoms or a divalent fluorine-containing alkylene group having 2 to 100 carbon atoms and ether bond.

9. The method of forming a laminated photoresist of Claim 7, wherein the structural unit M1 is a structural unit derived from a

fluorine-containing monomer represented by the formula (3):



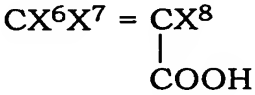
(3)

wherein X^1, X^2, X^3, X^4, X^5 and a are as defined in said formula (1); Rf^2 is a fluorine-containing alkyl group which has 1 to 10 carbon atoms and may have ether bond; R^1 is at least one selected from the group consisting of H, a hydrocarbon group having 1 to 10 carbon atoms and a fluorine-containing alkyl group which has 1 to 10 carbon atoms and may have ether bond.

10. The method of forming a laminated photoresist of any of Claims 1, 3 and 4, wherein the fluorine-containing polymer (A) is represented by the formula (M-2):

- (M2) - (N2) - (M-2)

wherein the structural unit M2 is a structural unit derived from a fluorine-containing monomer which has -COOH group as the hydrophilic group Y and is represented by the formula (4):



(4)

wherein X^6 and X^7 are the same or different and each is H or F; X^8 is H,

F, Cl, CH_3 or CF_3; at least one of X^6, X^7 and X^8 contains fluorine atom, the structural unit N2 is a structural unit derived from a monomer copolymerizable with the fluorine-containing monomer of the formula (4), and

the structural units M2 and N2 are contained in amounts of from 10 to 100 % by mole and from 0 to 90 % by mole, respectively.

11. The method of forming a laminated photoresist of any of Claims 1 to 10, wherein the coating composition further contains (B) at least one solvent selected from the group consisting of water and alcohols.

12. The method of forming a laminated photoresist of Claim 11, wherein the coating composition further contains (C) at least one selected from the group consisting of ammonia and organic amines.

13. A coating composition comprising:

(A1) a fluorine-containing polymer having carboxyl group and

(B) at least one solvent selected from the group consisting of water and alcohols;

said fluorine-containing polymer (A1) has a number average molecular weight of from 10,000 to 750,000 and is represented by the formula (M-3):

- (M3) - (N3) - (M-3)

wherein the structural unit M3 is a structural unit derived from a

fluorine-containing monomer represented by the formula (5):

$$CX^{10}X^{11}=CX^{12}-(CX^{13}X^{14})_{a1}(O)_{c1}Rf^{10}-COOH \qquad (5)$$

wherein X^{10} and X^{11} are the same or different and each is H or F; X^{12} is H, F, Cl, CH_3 or CF_3; X^{13} and X^{14} are the same or different and each is H or F; Rf^{10} is a divalent fluorine-containing alkylene group having 1 to 40 carbon atoms or a divalent fluorine-containing alkylene group having 2 to 100 carbon atoms and ether bond; a1 and c1 are the same or different and each is 0 or 1,

the structural unit N3 is a structural unit derived from a monomer copolymerizable with the fluorine-containing monomer of the formula (5), and

the structural units M3 and N3 are contained in amounts of from 55 to 100 % by mole and from 0 to 45 % by mole, respectively.

14. The coating composition of Claim 13, wherein the fluorine-containing polymer (A1) has a number average molecular weight of from 31,000 to 750,000.

15. The coating composition of Claim 13 or 14, wherein in the fluorine-containing polymer (A1), the structural units M3 and N3 are contained in amounts of from 70 to 100 % by mole and from 0 to 30 % by mole, respectively.

16. The coating composition of any of Claims 13 to 15,

wherein the solvent (B) is selected from water and solvent mixtures of water and alcohol, and a content of water in the solvent (B) exceeds 65 % by mass based on the total weight of water and alcohol.

17. The coating composition of any of Claims 13 to 16, wherein the coating composition further contains (C) at least one selected from the group consisting of ammonia and organic amines.

18. The coating composition of Claim 17, wherein (C) at least one selected from the group consisting of ammonia and organic amines is at least one selected from the group consisting of ammonia and hydroxyalkyl amines.